

# NASA TECH BRIEF



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## Method for Removing Surface-Damaged Layers from Nickel Alloys

Electrical-discharge machining (EDM) produces a hard brittle layer of melted and redeposited material on the machined surface. This layer (0.001 to 0.010 inch) increases in thickness with roughness of the EDM cut and degrades the mechanical properties of the metal. A recently completed program to evaluate the effect of the EDM-layer on nickel-base alloys revealed ambient-temperature property losses as great as 81 percent in ductility, 15 percent in yield strength, and 27 percent in ultimate strength. The surface-damaged layer would be especially detrimental to components subjected to cyclic loading, by providing initiation sites for fatigue failure.

It has been found that the EDM-damaged layer can be effectively removed from René 41, Inconel 625, Inconel 718, and Monel K-500 by abrasive-grit blasting or electropolishing (at room temperature) at a current density of 5A/in.<sup>2</sup> in a water solution of phosphoric and sulfuric acids. Abrasive-grit blasting may cause detrimental side effects (i.e., surface strain hardening or warping of thin sections), making electropolishing the more desirable of the removal methods.

The blasted or electropolished surface can be inspected to ensure complete removal of the EDM-affected layer by etching in an HCl-H<sub>2</sub>O<sub>2</sub> solution

at room temperature for 1 to 5 minutes and visually examining the surface. Any remaining EDM-affected layer on the aforementioned alloys is darkened and made readily visible.

### Notes:

1. Although these removal and inspection procedures have been evaluated only for René 41, Inconel 625, Inconel 718, and Monel K-500, they would probably be effective for all nickel-base alloys.
2. Details may be obtained from:

Clearinghouse for Federal Scientific and  
Technical Information  
Springfield, Virginia 22151  
Price \$3.00  
Reference: B68-10522

### Patent status:

No patent action is contemplated by NASA.

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